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SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/364,334	12/27/94	COHN	0 UR993044

EXAMINER
CHOW, C

ART UNIT	PAPER NUMBER
2318	11

DATE MAILED: 07/15/96

B3M1/0715

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This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☑ This application has been examined ☑ Responsive to communication filed on 6/10/96 ☐ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), 0 days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☑ Notice of Draftsman's Patent Drawing Review, PTO-948.
3. ☐ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474..
6. ☐ _____.

Part II SUMMARY OF ACTION

1. ☑ Claims 1-18 are pending in the application.
   Of the above, claims _____ are withdrawn from consideration.
2. ☑ Claims 4-9 have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☑ Claims 1-3, 10-18 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☑ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____. has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).
12. ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____ ; filed on _____.
13. ☐ Since this application apppears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
14. ☐ Other

EXAMINER'S ACTION

Part III DETAILED ACTION

Response to Amendment

1. This office action is in response to Amendment A entered June 10, 1996. Claims 1-3 and 10-18 are presented for examination. Claims 4-9 have been cancelled by Amendment A.

2. The rejection to claim 9 is withdrawn due to the cancellation of that claim.

3. The rejections to claims 4-9 under 35 USC § 103 are withdrawn due to cancellations of the said claims.

4. The rejections to claims 1, 2, and 18 under 35 USC § 102(b) are withdrawn but have been replaced with corresponding rejections under 35 USC § 103. Additionally, a new grounds for rejection is given for claim 12.

5. The rejections to claims 3, and 10-11, and 13-17 under 35 USC § 103 are maintained, and repeated immediately after the rejection to claims 1, 2, 12, and 18.

7-12-96

Claim Rejections - 35 USC § 103

6. Claims 1, 2, 12 and 18 are rejected under 35 U.S.C. § 103 as being unpatentable over Yamazaki (Japanese Patent Application laid open 4-205852), which discloses the invention substantially as claimed.

As explained in the first Office Action, Yamazaki teaches a data storage system comprising: a solid state cache memory; the claimed storage element with moving part; a cache control system; and a means to access data stored on the storage element if a read/write request cannot be satisfied via access to the cache memory; and a cache replacement mechanism.

As to claims 1-2: Amended claim 1 recites two additional limitations not found in the originally filed claim 1, and further refines the behavior of the cache replacement mechanism. The first additional limitation found in amended claim 1 is a means for accessing data stored within the cache if a read/write request from the computer can be satisfied via an access to the cache memory. Yamazaki teaches this on page 5 of the translation, where it is stated that in the case of a cache hit, data is exchanged between the cache and host. The second additional limitation found in amended claim 1 is a means for designating selected data within the cache as new data in response to a write from the computer which updates data within the cache. Yamazaki inherently teaches this because the cache of Yamazaki manages write requests, which would necessitate a means of tracking dirty blocks in order to maintain cache coherency.

Yamazaki does not teach a cache replacement mechanism which flushes dirty entries when another disk transaction requires an access to the disk itself. It is well known in the art that there is a certain degree of risk to data coherency associated with write caching, since a failure in the cache or the power supply to the cache or the disk drive may result in lost data. It is also well known that spinning up a disk's platters takes a substantial amount of electrical energy, while maintaining a disk's platter at operating speed requires less power.

It is noted that caches are organized into blocks which are equal sized, and therefore the time it takes to transfer new data blocks is predetermined.

Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to have modified the cache replacement mechanism of Yamazaki by flushing dirty cache entries whenever the disk reaches operating speed as a result of a read/write request which required an access to the disk because such a modification would simultaneously offer the speed advantages associated with write caching as well as the power savings of Yamazaki while minimizing the possibility of data loss by ensuring that dirty data is flushed as soon as practical.

As to claim 12: It is noted that the storage device taught by Yamazaki is a magnetic disk drive (See, e.g., page 3 of translation.)

As to claim 18: This claim is a parallel method claim to the apparatus claim 1. Therefore claim 18 is rejected for the same reasons as set forth in the rejection of claim 1 above.

7. Claim 3 is rejected under 35 U.S.C. § 103 as being unpatentable over Yamazaki as applied to claim 1 above, and further in view of Hanson, *et al.* (US Patent 4,433,374). Yamazaki teaches every feature of the instant claim except for the cache bypass feature. See rejection of claim 1, above. Hanson teaches a cache/disk subsystem with a cache bypass feature. In particular, at col. 4, lines 60 through col. 5, line 66, Hansen teaches bypassing a disk cache for disk transactions which exceed a certain threshold. Indeed Hansen teaches that "extremely long data transfers usually involve data that is not likely to be used again soon." Col. 5, lines 1-3. It therefore would have been obvious at the time the invention was made to one of ordinary skill in the art to have combined the teachings of Yamazaki and Hansen to have arrived at the claimed invention because a cache bypass feature for large data transfers would increase the cache efficiency by maintaining a high cache hit ratio, since caching large transfers have been shown to be ineffective.

8. Claims 10 and 14 are rejected under 35 U.S.C. § 103 as being unpatentable over Yamazaki. Yamazaki teaches every element of claim 1 by using a magnetic disk drive as a data storage apparatus. See rejection of claim 1, above. Claims 10 and 14 differ from claim 1

only by specifying the use of an optical drive and MO disk drive as the storage apparatus, respectively. However, magnetic disks, optical drive, and MO disk drives are all well known forms of disk based computer memories. Each of these devices comprise a rotating disk shaped media and sensors mounted on an arm assembly for reading and/or writing the data. Additionally, these devices may use the same computer interface, such as SCSI-2. In other words, these devices are analogous, and differ primarily in reading/writing methods, performance, capacity, and ability to withstand environmental stresses. Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to have substituted either optical or MO drives as the storage apparatus depending upon the suitability of such devices to the intended application or the environment where the computer system will be situated.

9. Claims 11, 13, and 15 are rejected under 35 U.S.C. § 103 as being unpatentable over Yamazaki as applied to claims 10, 12, and 14, respectively above, and further in view of art common knowledge. Claims 11, 13, and 15 differ from their parent claims of 10, 12, and 14 by containing the additional limitation that the claimed storage subsystem be used in either a personal computer or a portable computer. It is common knowledge that many disks, optical, or MO storage subsystems may be used in a variety of computers, ranging, for example, from engineering workstations to desktop PCs, to notebook and laptops, and

sometimes even gaming consoles. The claimed storage subsystems has an advantage in it minimizes the use of electrical power, a goal which is both desirable in desktop PCs (where it reduces electrical utility costs) and especially in portable systems (where it would allow the portable system to run on batteries for a greater length of time). Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to have placed the storage subsystems claimed in claims 10, 12, and 14 into either a personal computer or a portable computer in order to optimize the use of power.

10. Claim 16 is rejected under 35 U.S.C. § 103 as being unpatentable over Yamazaki as applied to claim 1 above, and further in view of Noya *et al* (US Patent 5,420,983). Yamazaki teaches every feature of claim 1. Claim 16 differs from claim 1 by having the additional limitation that the cache be non-volatile. Noya teaches a disk subsystem which uses non-volatile memory for a disk write cache. (Noya, col. 5, 30-40). In particular, Noya states that non volatile memory is used in the write cache to prevent any power failure related data corruption. While the present invention is not concerned with data corruption due to power failures, it is focused on minimizing the amount of electrical power consumed by the storage subsystem by inducing power failures in selected subsystems. If non-volatile memory were used for the cache, it would allow the storage subsystem to power down the cache after a period of inactivity without incurring any power penalty associated with having an empty cache, and thereby requiring new disk accesses to involve powering up the

drive motor. Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to have combined the teachings of Yamazaki and Noya to arrive at the claimed invention because using nonvolatile memory as a cache would lead to additional power savings.

11. Claim 17 is rejected under 35 U.S.C. § 103 as being unpatentable over Yamazaki and Noya as applied to claim 16 above, and further in view of art common knowledge. Collectively, Yamazaki and Noya teach every feature of claim 17 except for the additional limitation that the disk subsystem be used with a personal or portable computer. It is common knowledge that many disks subsystems may be used in a variety of computers, ranging, for example, from engineering workstations to desktop PCs, to notebook and laptops. The claimed storage subsystems has an advantage in it minimizes the use of electrical power, a goal which is both desirable in desktop PCs (where it reduces electrical utility costs) and especially in portable systems (where it would allow the portable system to run on batteries for a greater length of time). Therefore, it would have been obvious at the time the invention was made to one of ordinary skill in the art to have placed the storage subsystems as claimed in claims 16 into either a personal computer or a portable computer in order to optimize the use of power.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher Chow whose telephone number is (703) 308-6674. The examiner can normally be reached on Monday through Thursday from 7:00 to 5:30.

If attempts to reach the examiner by telephone are unsuccessful the examiner's supervisor Tod Swann can be reached on (703) 308-7791. The fax phone number for this Group is (703) 308-5357.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 305-9600.

CSC

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TOD R. SWANN
SUPERVISORY PATENT EXAMINER
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